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The Federal R&D System: Creaking and Ripe for Reform

Backed by organizational interests and distrust of change, the arrangement of federal agencies for the conduct and support of research has changed little over the past 35 years. Its standard battlecry is the glib formula for stagnation: "If it ain't broke, don't fix it." Its salvation, until recently, was a gusher of money that salved many shortcomings.

Today, however, the political system is obsessed with both frugality and an overblown faith in research as an economic elixir. But, in matters ranging from the initially slow response to AIDS to the astonishingly inept management of the space program, politics feels let down by its cherished research establishment. Having supported it lavishly for decades, it now finds the research system creaky and unresponsive to changes in political and economic concerns. Science, in turn, finds the political system failing in its long-established role of paying for the programs and equipment that underpin the practice of science.

Industrial competitiveness is politically hot, and research is extolled by politicians, industrialists, and sci-

ent interest to rate time in the presidential campaign. As the *Wall Street Journal* noted on August 9, the candidates often plug big R&D projects of local interest—Bush, for example, hinting in Huntsville, Alabama, at a manned Mars mission; Dukakis, in the Silicon Valley, trumpeting the importance of civilian research, and elsewhere waffling on the space station. But, as the *Journal* pointed out, "Detailed discussions of science policy get lost in the bustle of a presidential campaign."

More exactly, they don't occur. Nonetheless, the economic

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In Brief

Foreign governments would pitch in significantly on the costs of the Superconducting Super Collider (SSC), if Congress would only pass an authorization for the \$4.4 billion project, the Department of Energy has repeatedly assured Capitol Hill. But at the Washington embassies of several major nations, the DOE assertion is dismissed as fantasy. "Maybe some money from Japan," said a European science attache, "but the SSC will get nothing from Europe."

Robert O. Hunter's nomination as Director of the Office of Energy Research, in the Department of Energy, was approved July 27 by the Senate Energy and Natural Resources Committee—14 months after the White House named him for the post. The stall is reported to be linked to questions about Hunter's ties to Western Research, a defense firm he formerly headed. Approval by the Senate is still to come at this writing. The energy office is the command post for the bogged-down campaign to sell Congress on the SSC. During the long hiatus, the office has been headed on an acting basis by James F. Decker.

Remember the Council on Environmental Quality (CEQ), the Presidentially appointed three-member body established in 1969 as the principal White House adviser on environmental matters? It was influential in the old days, but like other creations from the era of domestic activism, it has barely survived the Reagan anti-government government. The CEQ budget was \$3.4 million when Reagan took office. For fiscal 1989, the White House requested and received from Congress \$870,000.

Included in the mammoth trade bill passed by Congress: a directive for the National Academies of Science and Engineering to conduct "a thorough review" of technology transfer between federal and civilian research organizations. Behind the directive is the old concern that too much federal R&D is remote from the nation's economic needs.

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entists as an essential ingredient of economic well-being. But a tangible focus on competitiveness, as distinguished from mere proclamations and musclebound strivings, barely shows up in the research agencies that manage the \$62 billion a year that Washington provides for R&D. Technology transfer from the \$20 billion of that total spent in federal labs is minuscule—despite a Presidential executive order throwing open the doors of government research centers to industry. The Congressional Office of Technology Assessment, respected on Capitol Hill as expert and non-partisan, is a fount of gloomy studies on poor American performance in developing new technologies and winning high-tech markets (SGR July 15).

Meanwhile, the political system for buying big equipment for research—previously based on promises of good scientific returns—is paralyzed by financial constraints, and no device exists for working out choices. The ultimate symbol of stalemate in American science-policy affairs is the Superconducting Super Collider, evasively put on ice until the next Administration, while its proponents vainly rattle the tin cup in foreign lands in hopes that Congress will be persuaded if Europeans and Japanese provide some money.

The issues of science policy are too remote from pub-

As Seen by OECD: A New Trend in US Graduate Education

From Science and Technology Policy Outlook 1988 (110 pp., \$18), a report by the Organization for Economic Cooperation and Development (OECD), Paris-based policy-research consortium of 24 industrialized nations. The authors are Robert Brainard, OECD Secretariat; Charles Leedman, Australian Department of Industry, Technology and Commerce, and James Lumbers, Australian Commonwealth Scientific and Industrial Research Organization.

In the [US], even the great flexibility of the existing higher education sector has not been equal to the needs of industry. US firms now spend about \$80 billion annually on training their staff, similar to the amount spent by all public and private universities and four-year colleges. IBM, one of the largest investors in research and staff training, now devotes about 8 percent of its wage costs bill to personnel development . . .

Corporate Universities

In the US, many firms have formal state accreditation for degree courses up to and including the PhD level or contract out specialized training needs to academics willing to cooperate with them. The corporate research journal, thesis and university all exist. Some may appear as a caricature of respected academic institutions, but others are equal to the highest academic standards and provide education in the social sciences and humanities along with training in technical specializations. The 1985 Carnegie Foundation [for the Advancement of Learning] report, *Corporate Classrooms*, identified 18 degree-granting corporate colleges; another five corporations were planning to introduce nine more programs in, for example, semiconductor design, systems engineering and business administration.

Another development is the National Technological University (NTU) in the United States [headquartered at 406 S. Howes St., Fort Collins, Colorado; tel. 303/484-6050], which may be the satellite model for the global university. The NTU is an independent non-profit institute serving major business corporations and US federal agencies. It uses advanced communications and information technology to broadcast (live and videotaped) courses in science and engineering to students at their place of work. The NTU is a merger of corporate and university concerns in which firms such as Westinghouse, Hewlett-Packard and Control Data Corporation contributed time and resources to launch the organization while

universities prepared courses at the advanced-degree level.

A version of NTU is planned for Western Europe in the form of the European Program of Advanced Continuing Education (PACE) . . . Like NTU, PACE is largely an initiative by industry with firms such as British Telecom, Hewlett-Packard, IBM, Philips, and Thomson promoting the program in association with the European Society for Engineering Education. Plans call for the program to concentrate during the 1988-90 period in six areas of advanced technology, including micro-electronics, computer software, manufacturing technologies and technology management . . .

A hybrid research system of public institutions and private sector organizations is a new development for some countries which may require new structures and procedures for the purpose of setting priorities and allocating resources. Few countries appear to be addressing this matter although a small number . . . have recently reorganized their governmental structures in ways which integrate responsibilities for science, technology and industry and provide for greater participation by the private sector in policymaking . . .

Skepticism Aroused

[But] considerable concern and opposition has been expressed regarding some aspects. One of these is the question of how far academic institutions should go in their collaboration with industry and in their own commercial ventures. This issue is being raised not only by academics but also by some industrialists who regard education and basic, curiosity-driven research as the essential and most important function of academic institutions. These functions are being seriously undermined, according to this view . . .

Despite its importance, diffusion [of technology from laboratory to industry] receives little attention in the context of science and technology (S&T) policy in most OECD countries. The focus instead is almost exclusively on innovation—on research and development of technology. This makes the 'supply' of new technology the primary, and even the ultimate, aim of policy in many countries. The spread and effective adoption of the new technology into the economy is largely neglected as an objective of S&T policy.

OECD publications are available at OECD offices and booksellers in many major cities throughout the world. In the US: OECD Publications and Information Center, Suite 700, 2000 L St. NW, Washington, DC 20036-4095; tel. 202/785-6323.

... New Name and Bigger Role for US Bureau of Standards

(Continued from page 1)

onomic structure of American science is becoming so wobbly and short of its productive potential that the consensus for an overhaul is mounting. The signs are many, big and little.

Prominent among them was broad political and news media attention to the proposal last spring by Frank Press, President of the National Academy of Sciences, for development of a priority system for "big science" (SGR May 1). Press's proposal was neither new, daring, nor precise. But it caught the political wave.

Another sign is the unusually heavy outpouring of legislative proposals for doing something new, or doing things differently, in federal R&D affairs. Many are linked to competitiveness and superconductivity or biotechnology—two fields about which many Congressmen writhe with concerns that the White House and the old-line federal R&D structure are ineffectively bumbling along. Under Gramm-Rudman-Hollings deficit-cutting pressures, there's no big money for new programs, so the legislative proposals actually add up to little.

Written into Trade Bill

But, mainly as a matter of symbolic value, some have made it into law, particularly as amendments to the Omnibus Trade and Competitiveness Act, which has been passed over the President's veto. Rolled into that 1125-page bill, among other research-related items, is the Technology Competitiveness Act of 1987, introduced by Chairman Robert Roe (D-NJ), of the House, Science, Space, and Technology Committee, and Chairman Ernest Hollings (D-SC), of the Senate Commerce, Science, and Transportation Committee.

The Roe-Hollings amendment rechristens the National Bureau of Standards as the National Institute of Standards and Technology. And it authorizes the new Institute to conduct a variety of activities aimed at boosting industrial technology, including the establishment of regional technology-transfer centers. In addition, the Secretary of Commerce is authorized to promote joint R&D ventures, along the lines of the Sematech consortium that the Pentagon is subsidizing for research on semiconductor manufacturing.

As an authorization act, the legislation only says what's to be done, but does not provide money to do it. However, not all the provisions require funding, and in any case, the Congressional intent is clear—government, particularly through its laboratories, should do more for industry.

The most challenging concept for shaking up the federal science establishment—amalgamation of several research agencies into a new cabinet-level depart-

ment—has been fought off for decades by guardians of scientific pluralism. Their main argument is that financial safety for science lies in a diversity of appropriations subcommittee chairmen on Capitol Hill; that a single science agency, which would normally come under just one chairman in each chamber, runs the risk of the seniority system elevating a hostile figure, *a la* penny-pinching Senator William Proxmire, to a lordly position over money for science. Cabinet status might be beneficial, science's political strategists agree, but the potential dangers are frightening.

Hard times are causing some reconsideration of those fears, and a new consensus may be in the making. Several scientific mandarins have in recent times privately conceded that conditions have changed to the point where the department concept no longer warrants automatic opposition. A cabinet seat, they say, might be beneficial for science, especially since Congress in recent years has shown less tolerance for dictatorial subcommittee chiefs.

In 1984, at the suggestion of then-White House Science Adviser George A. Keyworth II, the President's Commission on Competitiveness endorsed creation of a federal Department of Science. The proposal attracted little support and quietly sank out of view. But, in one form or another, it's always in the wings, awaiting a favorable atmosphere. There's usually a bill in Congress calling for creation of some kind of federal science department—the current one being HR 2164, introduced by Rep. George Brown (D-Calif.)

The formulations in these bills vary, but generally they call for a single agency to house the National Science Foundation, NASA's and the Department of Energy's scientific functions, and the National Bureau of Standards (NBS). Five or six years ago, the focus was on protecting and nurturing basic research. But since science in the cause of industry now grips the political imagination, there's currently more of a utilitarian fla-

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... Science Lobby Focuses on White House Science Advice

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vor to the departmental campaign.

The name change and new functions for the Bureau of Standards were preceded by many years of criticisms about its circumscribed role in assisting American industry. Another complaint—still valid, even under the new setup—is that NBS is a poor relation within its parent agency, the Department of Commerce. If politics is serious about extracting industrial value from the federal government's massive R&D expenditures, critics have correctly asserted, Commerce should pay more attention to technology. Among the advocates of that position is Lewis Branscomb, Director of the Science, Technology, and Public Policy Program at the Kenendy School, Harvard.

Branscomb, a former Director of NBS, is associated with the Dukakis camp (SGR, June 1), and is considered to be in the running for Presidential Science Adviser in a Dukakis Administration. The recasting of NBS as authorized in the trade bill moves along the lines advocated by the critics of the old regime. But the Reagan Administration, which opposed the changes, is not the vehicle for carrying them out vigorously.

CPR for Science Advice?

Central to any effective revamping is a renaissance for the White House science advisory apparatus, which has diminished into an odds-and-ends political job shop in the final years of the Reagan Administration. The White House's low regard for the advisory operation was reflected in a 10-month hiatus between Keyworth's resignation, announced late in 1985, and the appointment of his successor, William R. Graham, an obscure nuclear-weapons researcher under whose direction the office has crumbled into bureaucratic obscurity.

As called for by the loudest critics, a revival would include restoration of the presidentially appointed council of scientific wise men that Richard Nixon abolished in 1973 along with the science office. The council was revived on paper when the office was restored in 1976 by Gerald Ford, but it has never flourished. The restoration drumbeat got louder this month when the big industrial-academic R&D lobby, CORETECH, publicly urged candidates Bush and Dukakis to lavish attention and support on science and technology.

Of course, they won't do that, since there's little political paydirt in the intricacies of R&D policy or support for science. But though the candidates won't embrace R&D as a profitable campaign issue, CORETECH is well situated to get its views delivered to politically influential people around the candidates. The organization represents 48 high-tech companies, 81 universities,

and 17 trade and professional associations. One of its lobbyists is Stuart E. Eizenstat, chief of domestic affairs in the Carter White House, who is working with the Dukakis campaign. CORETECH's publicly released resolution to the candidates proceeds from the premise that the US is poorly managing its scientific and technological resources, and that the next President should swiftly appoint capable help to do something about it. The resolution was accompanied by letters to the candidates stating:

"We are concerned that both public and private science and technology efforts in this country are not always reaching their potential because governmental policies affecting science and technology are fragmented. This prevents them from being a high enough priority. It is also a barrier to coordinated research efforts, including those that are necessary for some critical new technologies."

Cabinet Status?

The resolution itself calls for appointment of a *cabinet-level* Presidential Science Adviser at the beginning of the new Administration, and it also urges "the next President to bring science and technology policy issues to national attention in his first State of the Union address and to make specific proposals on how to address these issues." Of particular importance, CORETECH states, are scientific and technical areas "that affect the country's industrial competitiveness."

The CORETECH ploy, with its tinge of panic, is a replay of many previous attempts to regain the place at court that the elders of science possessed in the long, long ago Kennedy and Eisenhower Administrations. Science-related events during those periods have been glossed over by a golden nostalgia that does not bear up to historical scrutiny. But no matter, the science establishment wants its office and staff at the White House, the frantic busyness that so often passes for work in Washington, and accompanying glimpses of the White House social whirl (science has never made it big on that circuit, but it is allowed some peeks).

On the issue of Presidential science advice and where it would be located in the Executive Branch, neither candidate has jumped at the bait set out by CORETECH or the other research-related organizations that play the quadrennial game of trying to pin down the candidates. Bush, at least up to convention time, has been silent on the subject, while Dukakis has praised the importance of presidential science advice, but without making promises about how he would obtain it.

If the leaders of science and their Congressional

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... The Neglected Power of OMB for Shaping R&D Policy

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friends were disinterestedly searching for a better style of organization for federal science affairs, they would quickly shed the nonsensical notion of a cabinet officer without portfolio for science, a status recommended by CORETECH, Academy President Press, and others. "Without portfolio" is another term for without power or influence, unless, of course, the power and influence originate in a personal relationship with the President, in which case the cabinet title is superfluous.

What's needed for shaping up the federal side of American science is an effective linkage to control over money for science. And, in the Executive Branch, control over money is principally lodged in one place—the Office of Management and Budget (OMB). What science needs is not a meaningless elevation in the White House hierarchy, but an effective role in budget formulation and control of spending. The President does indeed need the services of a science adviser, but his most effective location would be as an Associate Director of OMB, with a specialized staff.

That would involve a descent in the White House hierarchy—which would automatically make it unacceptable to the hallucinatory school of Presidential science advice. No great captain of science would accept so ignominious an assignment. But, as a matter of fact, a solid footing in OMB would provide an opportunity for more influence than any of the variety of schemes that would set up science advice as a separate operation in the Executive Office of the President or as a part of the closer-in White House staff.

The record shows that recent Presidents have not yearned for intimate relations with their science advisers. The last time a President was on a close footing with his science adviser was in 1963, a long time ago, even if it seems like only yesterday to some.

The essential element in current science-government relations is the inability of each party to deliver for the other. Many of the problems originate in factors beyond the boundaries of science, among them the nation's short attention span and the power-clutching baronies of Capitol Hill. Little can be done about them, at least in the short run, but within the Executive Branch, some remedies are within reach. And, it's important to note that some of the most innovative thinking about the nation's research enterprise is taking place on Capitol Hill. After all, that's where the expanded industrial role for the National Bureau of Standards was mandated—over the opposition of the Reagan Administration.

OMB's immense power has rarely been used for setting and enforcing scientific priorities, pushing collaboration among federal research agencies, or getting industrial mileage out of the nation's vast expenditures on

NIH Reassigns Fraud Office Head

Mary Miers, head of the fraud squad at NIH since 1983, has been quietly reassigned to a new post, Chief of Legislation and Analysis in the National Institute of Neurological and Communicative Disorders and Stroke, SGR has learned.

Her tenure was marked by charges that NIH was indifferent to fraud, as evidenced by interminable Kafkaesque proceedings in misconduct cases, some of which ran on for years, often without serious investigative efforts to ascertain basic facts. Miers was singled out for a particularly heavy barrage of Congressional abuse when NIH's handling of fraud complaints was reviewed at Congressional hearings (SGR, April 15). The reassignment was made without public announcement.

The fraud office, officially titled Institutional Liaison in the Office of Extramural Programs, is currently without a Director. Following the Congressional hearings, NIH Director James B. Wyngaarden added several members to the staff, and ordered it to clean up the image of NIH as complacent on fraud.

Still pending on the roster of cases there is the long-simmering complaint about a paper in the April 25, 1986, *Cell*, whose co-authors included Nobelist David Baltimore. In the spring, NIH appointed a three-member committee of outside consultants to review the paper and the circumstances of the complaint. Miers told SGR in early July that the committee's report would probably be delivered to Wyngaarden by August 15. But the latest word is that delivery will be somewhat later than that.

The members of the committee are Ursula Storb, University of Chicago; Joseph Davie, Searle Pharmaceutical, and Hugh McDevitt, Stanford University.

the federal labs. A succession of White House science advisers has lamely complained that few federal agencies pay enough or even anything at all for the basic research that shows up in the technologies they depend on—the Pentagon being a prime example of what NSF Director Erich Bloch once referred to as a "free rider." The problem is correctable, if OMB and its political chiefs can be persuaded to correct it.

In science affairs, expect nothing from the Reagan Administration beyond the sounds of expiration. But wait till next year. There won't be much talk about science and technology issues in the Presidential campaign. But the old system is crumbling, as sensible scientists and politicians realize, and the makings of a new day are visible.—DSG

Drugs for AIDS: FDA's Misguided Gesture of Compassion

Dying people cannot be denied hope. That's what the Food and Drug Administration said in announcing last month that AIDS patients may import personal dosages of medicines not certified for use in the U.S.

A humane move? So it appears, and thus it is welcome for the battered image of the FDA, whose routinely cautious regulatory procedures have enraged AIDS patients and drawn Congressional scorn. But there's little chance that the new drug policy will help AIDS patients, and there's a major likelihood that it will actually set back the search for effective drugs.

The FDA's decision was politically unavoidable, given the continuing spread of the disease, the absence of durably effective treatments, and shrill but false reports that life-saving drugs are available abroad but illegal here. However, the problem goes beyond FDA, which is only one bureaucratic part of the war on AIDS.

Seven years into the AIDS epidemic, research and the quest for treatments remain considerably short of the all-out effort that has been urgently recommended by numerous official commissions. For example, the National Institutes of Health (NIH), the headquarters and financier for the bulk of basic AIDS research, has admitted to Congress that shortages of administrative help had until recently delayed the deployment of millions of dollars of AIDS research funds.

The problem has since been cleared up, NIH says. But a disturbing fact is that the spending delays were needlessly prolonged by the old ploy of pretending all is well until forced to admit otherwise. In the early days NIH responded indignantly to charges of sluggishness in launching AIDS research projects. But today, even some of NIH's staunchest supporters acknowledge a poor start. Among them is Nobel Laureate David Baltimore, who recently stated that NIH "was slow to marshal the research community in the battle against AIDS."

Parts of that problem have been solved, but others remain, particularly in the mobilization of clinical tests for the difficult task of evaluating drugs on AIDS patients. Officials in Washington have publicly complained that many qualified university scientists are not interested in this work. As a result, the pipeline is filling up with untested drugs. NIH can exert a lot of influence, including the power of the purse in research affairs. But it still prefers a gentle approach to management.

The open door for foreign drugs portends a host of problems that can only multiply the sorrows of AIDS. The new policy promises riches for the many crackpots and frauds preying on AIDS patients. In the absence of rigorous, impartial testing, potentially useful drugs among the imports may be compromised by inappropriate dosages or combinations with other drugs. And, with hope-filled rumors luring patients to the under-

ground drug market, the pool of suitable patients for serious drug testing will be severely diminished.

The FDA was proceeding from a no-win position. But there should be no doubt about the reality of its new policy on AIDS drugs. Winking at the importation of unapproved foreign drugs is a diversionary tactic that placates desperate AIDS patients. But it does nothing to advance the understanding that is indispensable for developing effective treatments.—DSG

Job Changes & Appointments

Vincent T. DeVita Jr. has resigned as Director of the National Cancer Institute to become Physician-in-Chief at Memorial Hospital, Memorial Sloan-Kettering Cancer Center, NY. DeVita held the NCI post since 1980. A search committee has been appointed to recommend a successor.

Philip E. Schambra has been appointed Director of the Fogarty International Center for Advanced Study in the Health Sciences of the National Institutes of Health. Schambra served since 1984 as Science Attache at the US Embassy in New Delhi.

The White House has announced two appointments to the National Science Board, the 24-member policy body of the National Science Foundation: **D. Allan Bromley**, Professor of Physics at Yale, succeeds **Charles E. Hess**, UC, Davis; **Daniel C. Drucker**, Graduate Research Professor, University of Florida, Gainesville, succeeds **William F. Miller**, SRI International. The appointments fill vacancies resulting from the expiration of the board's six-year terms. **Bromley**, incidentally, has been mentioned here and there as a possible choice for Presidential Science Adviser in a Bush Administration.

Kenneth Ryan, Chairman of Obstetrics and Gynecology, Harvard, has been appointed by the Director of the National Institutes of Health to chair the scientific sessions of public hearings September 14-16 at NIH on transplantation of human fetal tissue. **LeRoy Walters**, Director of the Center for Bioethics at Georgetown University, will chair the sessions on ethics. A panel of 20-25 non-federal specialists, who will report to NIH and the Public Health Service, will be chaired by **Arlin Adams**, of Philadelphia, a retired Judge of the US Court of Appeals, Third Circuit.

Francois Kourilsky has been appointed Director of the *Centre National de la Recherche Scientifique*, the \$1-billion-a-year French government agency for basic research. He comes to the post from the directorship of the Immunology Institute in Marseilles.

John H. Ferguson, Baylor College of Medicine, has been appointed Director of the NIH Office of Medical Applications of Research, which administers the NIH consensus conferences.

In Print: Biotechnology, Israeli Research, Chem Weapons

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from an average of \$123,800 in 1983 to \$176,700 in 1987. During that time, funding rose by 65 percent but the number of grants increased by only 16 percent. The lurking suspicion is that cunning medical school bureaucrats are plundering the grants for administrative purposes. GAO, Congress's investigative arm, concluded, however, that the indirect-cost rakeoff (which comes off the top of grant awards) has been stable at about 31 percent since 1983—having risen there from 22 percent in 1970. The main culprits, says GAO, appear to be inflation—up 43 percent in 1983-87; higher personnel costs, and more complex and expensive equipment. But, beyond those factors, GAO says it can't be sure, and advises more study of the issue.

Biotechnology: Managing the Risks of Field Testing Genetically Engineered Organisms (GAO/RCED-88-27, 108 pp., no charge), report prepared at the request of Chairman John Dingell (D-Mich.) of the Committee on Energy and Commerce, describes the risk-management policies of the major federal agencies concerned with release of genetically engineered organisms: the Department of Agriculture, the Environmental Protection Agency, and the Food and Drug Administration. The GAO review concludes that they are proceeding cautiously but unevenly and recommends "some modifications to agency policies in order to narrow gaps in regulatory coverage."

US General Accounting Office, PO Box 6015, Gaithersburg, Md. 20877; tel. 202/275-6241.

Indicators of Clinical and Biomedical Research in Israel (201 pp.; charge not indicated), described as the first analytical study of a major field of research in Israel, the report exhaustively covers budgets, manpower, citations, foreign collaboration, etc., and concludes that Israel is slipping in international standings in both clinical and biomedical research. Even so, the report notes, Israeli biomedical research remains quite strong; also, that with \$40 million in grants from the US National Institutes of Health from 1976 to 1985, "Only Canada benefitted financially more than Israel from these international programs . . ." The report was co-authored by Shlomo Herskovic, Head of Economics and Science Policy, National Council for Research and Development, and Bruno Lunenfeld, Professor of Endocrinology, Bar-Ilan University.

Weizmann Science Press of Israel, PO Box 801, Jerusalem 91007, Israel.

Technical Cooperation and International Competitiveness (320 pp., \$25), in the old torpid tradition of academic publishing, fresh off the press, proceedings from

a conference in April 1986, with a squad of heavyweight co-sponsors, including NSF, NATO, OECD, the National Research Council of Italy, Xerox and Pfizer. Included are papers by some 40 senior academics, industrialists, and government officials, from many lands, with topics including military spinoff, industrial R&D consortia, US-Japan cooperation, national R&D policies, etc. Contrary to what might be expected from so ponderous an enterprise, the ensuing thick, late volume contains a good many carefully prepared, informative papers.

Center for Science and Technology Policy, Rensselaer Polytechnic Institute, 725 Park Ave., New York, NY 10021; tel. 212/772-8120.

Chemical Weapons Convention Bulletin (16 pp., first three issues free; then, \$10 annual contribution suggested), a new quarterly newsletter by the Federation of American Scientists Fund and the Institute for Defense and Disarmament Studies, focuses on chemical-weapons negotiations that, after long inactivity, are showing motion in Geneva. Co-edited by Matthew Meselson, Harvard, and Julian Perry Robinson, University of Sussex, UK.

Federation of American Scientists, 307 Massachusetts Ave. NE, Washington, DC 20002; tel. 202/546-3300.

SGR Summer Schedule

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The following publications are obtainable as indicated—not from SGR.

Three by the Congressional Office of Technology Assessment:

Educating Scientists and Engineers: Grade School to Grad School (GPO Stock No. 052-003-01110-7, 128 pp., \$6), report produced for the House Science, Space, and Technology Committee by a panel chaired by Neal F. Lane, Provost, Rice University. Says the demographic dip need not result in the widely predicted shortage of scientists and engineers, if schools upgrade the quality of instruction, more women and minority-group members are encouraged to study science, and the federal government boosts assistance to undergraduate and graduate science students. Though confined by the rules to listing policy options, the OTA report whispers loudly that increased federal spending—rather than mere Reaganite exhortation—is the needed ingredient for producing more scientists and engineers.

Urban Ozone and the Clean Air Act: Problems and Proposals for Change (GPO Stock No. 052-003-01097-6, 160 pp., \$8.50), an OTA staff paper, prompted by pending amendments to the Clean Air Act, reviews the sources and health effects of ozone, methods of control, widespread failure to meet the standards in 1977 legislation, and the contents and potential of current legislative proposals.

New Developments in Biotechnology: US Investment in Biotechnology (GPO Stock No. 052-003-01115-8, 304 pp., \$13), reports \$2.7 billion, spread among a dozen federal agencies, was spent on biotechnology R&D in fiscal 1987, plus \$1.5 to \$2 billion by industry, and \$147 million by state governments. For the annals of absurd scientific priorities, the OTA listings provide an item: Biotechnology spending by the Pentagon, \$119 million; by the US Department of Agriculture, \$84 million. The report is the fourth in OTA's biotechnology series. Earlier titles: *Ownership of Human Tissue and Cells; Public Perceptions of Biotechnology; Field-Testing Engineered Organisms*.

Superintendent of Documents, USGPO, Washington, DC 20402; tel. 202/783-3238.

US Pharmaceutical Industry: Annual Survey Report, 1986-1987 (32 pp., no charge), by the Pharmaceutical Manufacturers Association, provides a mass of data on the industry's R&D spending (up by 15 percent from 1986-87, for a total of \$5.4 billion); worldwide sales (up 11 percent, to \$41 billion), and employment (319,000, of whom 47 percent work abroad).

Pharmaceutical Manufacturers Association, Communications Department, 1100 15th St. NW, Washington, DC 20005; tel. 202/835-3464.

Two by the National Academy of Sciences Office of Scientific and Engineering Personnel:

The Effects on Quality of Adjustments in Engineering Labor Markets (144 pp., no charge), report of a study chaired by Harrison Shull, University of Colorado, on the workings of the market for engineers. Says that career shifts, immigration, and in-service retraining have made up for the shortfall in new graduates, without apparent loss of workforce quality, according to limited available evidence. The report says foreign engineers are essential for academe and industry and advises against imposing barriers to their entry, but adds that the real problem is a dearth of American PhD candidates, and urges more federal money to lure engineers back to school. The report states that there's no evidence that declining US industrial competitiveness is due to lack of qualified engineers.

Engineering Personnel Data Needs for the 1990s (77 pp., no charge), report of a study chaired by John McTague, Vice President for Research, Ford Motor Co., recommends more extensive collection and analysis of data on student career choices, occupational mobility, immigration of engineers, etc.

National Academy of Sciences, Office of Scientific and Engineering Personnel, 2101 Constitution Ave. NW, Washington, DC 20418; tel. 202/334-3186.

Two from the US General Accounting Office:

Biomedical Research: Issues Related to Increasing Size of NIH Grant Awards (GAO/HRD-88-90BR, 54 pp., no charge), response to a request from NIH's House Appropriations Subcommittee for a review of the rapid growth in the size of NIH research project grants—up

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